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Turkish Young Children's Views on Science and Scientists*

Sinan ÖZGELEN[a]
Mersin University

Abstract

The purpose of the study was to investigate 3rd grade primary students' views on science and scientists. The sample was consisted of 254 3rd grade public school students, in Mersin. Primary students were asked to answer three basic questions; 1) What is science? 2) Who does science? 3) How science is done? Primary students were requested answers written, and gave a choice if they want draw a picture for these questions. This study is exploratory in nature. The qualitative approach data collection methods were applied. In this study, the analyses of documents were separated in two main parts. First one is written responses for the three questions. The second is students' pictures, which primary students draw on the page. For the analysis of stereotypic features of students' drawings Chambers' DAST score card was used. Results were discussed according to national and international related literature. At the national level 3rd grade students had less stereotype images of scientists than upper classes. At the international level Turkish primary students' perceptions/views science and scientists are more realistic than other countries. Undoubted, these positive perceptions and views affect their attitudes toward science and scientist.

Key Words

Young Children, Views, Science, Scientists.

Science education reforms around the world emphasis on understanding of science and values about science in different schools levels (American Association for the Advancement of Science [AAAS], 1993; National Research Council [NRC], 2000; Turkish Ministry of National Education [MoNE], 2000). Investigating students' understandings about science is important, because reforms movements aimed to grow students as scientific literate people, who understand nature of science, make right decision about life, are aware of environmental issues, and take democratic roles in society (NRC).

Reform movements aimed to develop students' views of science as a way of knowing, scientific literacy includes not only science process skills but also thinking and talking its own history, philosophy, values, and beliefs (Rosebery, Warren, & Conant, 1992). It is agreed on that, views about science and scientists are socially constructed. This means that during science, learning ideas of scientific community are concerned, but these ideas are meaningful at a personal level (Driver, Asoko, Leach, Mortimer, & Scott, 1994).

Why scientists' images are important for primary students? Students' attitudes toward science are essential, during their educational life and choice

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a **Sinan ÖZGELEN, Ph.D.,** is currently an assistant professor at the department of elementary science education. His research interests include students and teachers' views about nature of science, inquiry-based instructions, and scientific literacy. Correspondence: Assist. Prof. Sinan ÖZGELEN, Mersin University, Faculty of Education, Department of Elementary Science Education, 33150 Mersin /Turkey. E-mail: sozgelen@gmail.com Phone: +90 324 341 2024 Fax: +90 324 341 8789.

of occupation after the school. Primary students construct their stereotype images; these images reflect their v iewpoints about science and scientists. Generally, primary students have stereotypes images for science and scientist, one of the reasons it, they do not have first-hand experiences and knowledge about science (Talsma, 2007).

Some researchers suggested the relation between students' stereotypes of scientists and their attitudes toward science (Bodzin & Gehringer, 2001; Flick, 1990; Mason, Kahle, & Gardner, 1991). Attitudes are affected from learning by model-making. In addition, observations affect students' views about science and scientists. Primary students observe their parents, teachers, and people on TV, in newspaper. Primary students come into schools with their own previous knowledge and ideas. During instruction students either redesign their existing views, or change according to classroom activities. One of the first studies about this topic was conducted by Mead and Metraux (1957), who asked American high school students to write about their views of scientists. The study revealed the stereotype images of scientists for high school students, as famous description in the literature;

> *The scientist is a man who wears a white coat and works in a laboratory. He is elderly or middle aged and wears glasses . . . he may wear a beard. . . he is surrounded by equipment: test tubes, bunsen burners, flasks and bottles, a jungle gym of blown glass tubes and weird machines with dials . . , he writes neatly in black notebooks . . . One day he may straighten up and shout: "I've found it! I've found it!". . . Through his work people will have new and better products. . . he has to keep dangerous secrets . . . his work may be dangerous . . . he is always reading a book (p. 386).*

Because of some difficulties writing essay for students, Chambers (1983) developed the Draw-A-Scientist Test (DAST). Chambers aimed to discover students' image of a scientist and to establish the age in which characteristic first develop. This test gives chance for students to draw their views about scientists. Chambers collected data from 4807 children in 186 classes from kindergarten to grade five (majority were from grades two and three). Based on the literature Chambers determined seven characteristics as indicators of the standard image of scientists. There are; 1) Lab coat; 2) Eyeglasses; 3) Facial growth of hair; 4) Symbols of research; 5) Symbols of knowledge; 6) Technology; and 6) Relevant captions (Chambers). Comparing students' grade levels Chambers concluded that "the standard image has begun to appear in the child's consciousness in the second and third year of schooling; by the fourth and fifth year the image, as a rule, has fully emerged" (p. 260).

Past studies about this topic revealed that overwhelmingly, children have a stereotypically image of science (Barman, 1999; Chambers, 1983; Chiang & Guo, 1996; Fung, 2002; Hill & Wheeler, 1991; Jones & Bangert, 2006). Stereotypic images of scientists may demonstrate negative attitudes toward science and scientists (Mason et al., 1991). Past studies showed that students perceive science, especially females' images of science and scientist can affect negatively their future careers (Finson, 2003). Since, students think that scientists must work hardly every time, they do not have a time for themselves and their families, and they have a limited kind of social life. Therefore, many students do not prefer being a scientist as a career after schools (Mason et al.).

In point of fact, many students do not have a chance to meet a scientist during their school life, they can easily describe some images of scientists in many ways (Rampal, 1992). A review about students' attitudes toward science in elementary by Koballa (1993) revealed that negative views started at early ages, especially between 8 and 13 ages are accepted the important time of influence. In this area there are some studies from different countries (USA, Turkey). In literature some researchers used Chambers' (1983) Draw-A-Scientist Test (DAST) (Barman, 1997; Song et al., 2011; Turkmen, 2008). Many studies conducted in grade early school, primary school, high school, and preservice teachers in universities. However, this study's sample consisted of primary students. In this study the sample was consisted of third year of schooling students. Therefore, their drawings are important indicator to show these age group children' views about science and scientists.

In this subject there are some studies, they concerned specifically primary students as samples (Barman, 1997; Song et al., 2011; Turkmen, 2008). These studies were reviewed and their results were compared to the present study at discussion part. First study conducted by Barman (1997). The researcher asked three questions to students; Will you draw a picture of a scientist doing science? Will you draw a picture of yourself doing science in school? Can you think of some ways you use what you learn in science outside of school? After

students' drawings interviews were conducted to fully understand meaning or intent of drawings. During the analysis of the drawings and students' interviews Draw-a-Scientists Checklist (DAST-C) (Finson, Beaver, & Cramond, 1995) was used. Students' stereotypes of scientists were exposed. In his study, Barman (1997) had three levels for students, K-2, 3-5, and 6-8, these groups provided comparisons among different aged students' views. In here, results of the 3-5 level were took, since the present study's sample is similar grade levels. Barman's sample was consisted of 649 primary students from 3-5 grades.

The second study was performed by Song et al. (2011). In their study, the researchers focused on changes primary students' views of scientists comparing with Barman's (1997) study. They applied DAST for data collection and DAST-C for data analysis. Their samples consisted of 52 third graders from two different classes in two different schools. During the analysis some stereotypic characteristics were identified according to the DAST-C characteristics of scientists. The researchers compared 3rd grade students' drawings with Barman's (1997) to show whether there were any changes in 3rd graders' views of scientists over the last decade.

Third study made by Turkmen (2008), he concentrated 5th grade students. Totally, 287 students were consisted of the sample (120 boys and 167 girls). In that study, DAST was used, each student asked questions that, Could you draw a picture of a scientist? When you are finished, Could you please explain What Scientist is doing? In his study, the researcher used second questionnaire regarding source of scientist image was adapted by Pedersen and Turkmen (2005). During the data analysis the DAST-C was applied, students' drawings were rated for specific stereotypic images, and also the researcher used some additional information obtained from the student narratives. These three studies results were compared and discussed with the present study at the discussion part.

Purpose of the Study and Research Questions

The purpose of the study was to investigate 3rd grade primary students' views on science and scientists. Science educators, elementary school teachers, and also pre-service teachers should be responsible for helping primary students develop adequate views of science and scientists. In this study, 3rd grade primary students' perspectives about science and scientists determined. One of the purposes of this study is to investigate what kinds of images of scientists primary students hold in their minds. The second one is whether the similar findings or not from national and international earlier studies.

The process of analyzing students' stereotypes of images has some uncertainties, because researchers or teachers identify and interpret students' drawings. Sometimes, this can cause misleading or oversimplify about students' drawings. Jarvis and Rennie (1995) suggested that in order to prevent misunderstanding, students should be required to add some sentences related to their stereotypes images of science and scientists. Therefore, in this study primary students were asked to answer three basic questions; 1) What is science? 2) Who does science? 3) How science is done? Primary students were released to respond by written or drawing pictures about these questions.

Method

Design

This study is exploratory in nature. The qualitative approach data collection methods were applied. These methods were open-ended survey questionnaire (Marshall & Rossman, 2006).

Sampling

The sample of this study was composed of 254 primary school students. All of the students were from 3rd grade, and they from 11 classes from three different public schools in Mersin city-center. During the determining schools and classrooms purposively and convenience samplings were applied (Marshall & Rossman, 2006).

Instrumentation

The researcher prepared a sheet, which included three open-ended questions from the literature. These questions are; 1) What is science? 2) Who does science? 3) How science is done? Open-ended questionnaire was used and tested before the study with similar sample, for bias, sequence, clarity, and face-validity. As a pilot study, the questions gave 15 primary students, after they completed, asked them; What do understand the questions? The questions were reviewed in terms of is there any incomprehensible part for primary students.

Table 1.
Coding categories for Scientist Images (from Talsma, 2007)

Personal Characteristics	Contextual features
1. Lab Coat (Usually but not necessarily white);	4. Symbols of research: instruments and equipment of any kind;
2. Eyewear, (glasses, goggles)	5. Symbols of knowledge: e.g. books and file Cabinets
3. Facial growth of hair (including beards, mustaches, or abnormally long sideburns);	6. Technology: the "products" of science'
	7. Relevant captions: formulae, classification, the "eureka! syndrome, etc. (Chambers, 1983)
8. Gender	12. Work Day (greater or less than 12 hours)
9. Race	13. Professional Collaboration / Isolation (assistants, colleagues)
10. Grooming (crazy hair)	14. Living arrangements (alone, with others "family")
11. Personality- positive (nice, normal, caring) or negative (crazy, mad, grump,).	

Primary students were asked these questions and requested answers written, and gave a choice if they want draw a picture for these questions. Drawing picture was optional, therefore, some of the students gave answer the questions written and draw pictures together. While some others only answered the questions, some others only choose draw pictures without answer any questions.

Data Collection

In the main study, the researcher determined 3 primary schools at the center of Mersin city. The researchers explained the study's aim 11 classroom teachers individually and requested them to apply survey to their students. Teachers were requested for directions in the survey without any orientation or helping to primary students' answers during the applications. Application of the survey took approximately 30 minutes. In order to prevent any disturb in classrooms environments the researcher did not enter the classrooms.

Using questionnaire the researcher rely totally on the honesty and accuracy of primary students' responses. In this study, some of the answer for the first question (What is science?) were detected answered by using dictionary thus, the researcher aware and deleted this answers.

Primary School Students and Textbooks

For the present study, the data collected from the 11 third grades, totally 254 primary students from three different public schools in Mersin. 3rd grade primary students textbooks were prepared and distributed by MoNE, and the same program is applied all of the national schools.

Related to science and scientists topics are placed in the "social science" course textbooks. The textbook includes three related topic for the present study. Fist one is about scientists, there are four famous Turkish scientists' life stories (only two pages). The second is related to occupations, include scientists (only two pages). Lastly, it is about original designs, technology etc. (only three pages). According to textbooks contents, there are some limited information about science and scientists for 3rd grade primary students.

Data Analysis

In this study, the analyses of documents were separated in two main parts. First one is written responses for the three questions. The second is students' pictures, which primary students draw on the page. In order to analyze primary students' written responses for the three questions, qualitative approach was used and some key words were defined students' sentences, than counted their frequencies and percentages. During the analyses process, a unit was stated a statement. Palmquist and Finley (1997) defined a statement as "a paragraph, group of sentences, sentence or phrase that contained a single unambiguous theme" (p. 600).

For the analysis of stereotypic features of students' drawings, those about science and scientists were coded using an extension of Chambers' (1983) DAST score card. Scientists' characteristics were identified as contextual and personal characteristics (Talsma, 2007). The following table was transformed from Talsma, and it brings together coding categories about images described for scientists in

Chambers' and Talsma's coding categories. During the analysis process, the researcher and one expert (she is elementary class teacher) coded separately. Then, they compared their codes for the all of the data. When there is inconsistent between them, they discussed and agreed on categories. According to Miles and Huberman's (1994), the coders' agreement rate on the criteria was 84%. After discussions about inconsistent codes inter-coder reliability on the merged codes was 90 percent.

Findings

All of the data, written responses and drawings were analyzed respectively. Before the data analyses, primary school students' answers and drawings were separated for the three questions in the survey. Since the primary students could answer the questions in two different ways as writing and drawings. Moreover, if they wished they could answer the questions by both writing and drawing. Table 2 showed the distribution of primary students' answers according to their response ways as writing, drawing, and both writing and drawing. According to results, more than half of the students (n=130; % 51.19) preferred answered the question both written and drawing pictures together. On the other hand, less than half of the students (n=119; % 46.85) responded the three questions only written. Just 5 primary school students (% 1.96) drew pictures for the three questions, they did not write anything about the three questions.

Table 2.
Distribution of 3rd Grade Students' Responses

Kinds of Students' Responses	f (254)	% (100)
Written Responses	119	46.85
Drawing Responses	5	1.96
Written and Drawing Responses	130	51.19

Analyses of Written Responses

Before starting data analyzes, the numbers of students answered questions were detected. As seen from Table 3, the first question (What is science?) was answered by 149 primary school students. On the other hand, 105 students did not answer this question. For the second question (Who does science?), 234 students responded while 20 students did not. The third question (How science is done?) was answered by 188 students while it did not by 66 students.

Table 3.
Distribution of Students' Answered and Unanswered Questions

Written Questions	N of Students Answered	N of Students Unanswered
What is science?	149 (% 58.66)	105 (% 41.34)
Who does science?	234 (% 92.12)	20 (% 7.88)
How science is done?	188 (% 74.01)	66 (% 25.99)

What is Science? Primary school students' answers for the first question were analyzed through content analysis (or open coding method) and their frequencies and percentages were noted. As a result of analysis of the students' responses, some codes were emerged. The Table 4 shows these codes and their frequencies. Since some codes related to each other, they were combined under "KIDS" abbreviation. Many primary students (% 80.67) responded the question with the concepts related to science as knowledge, search, discovery, and invention. Some of the students (% 16.67) expressed "technology" to define science. Only two students defined science as "curiosity" and one as "creativity". Lastly, one student used "entertainment" concept while defining the science.

Table 4.
Distribution of First Question's Answers

What is science?	f (150)	% (100)
Knowledge, Invention, Discovery & Search (KIDS)	121	80.67
Technology	25	16.67
Curiosity	2	1.34
Creativity	1	0.67
Entertainment	1	0.67

Who does Science? The answers of second question' were analyzed and also, detected their frequencies and percentages. More than half of the students (% 64.12) expressed "scientists" as an answer for the question. However, since using this word in structure of Turkish language, students used this word as "meaning of man". Many of the students (% 12.21) answered this question that "people" do science. Like previous code, many of the students (% 11.06) mentioned "curious persons" doing science. Some of the students (% 5.72) pointed "scientists" as an answer. Some of the primary students (% 3.44) responded the question as "professors". Six students' answers were "hardworking people" while 3 students' ones were "women scientists".

Table 5.
Distribution of Second Question's Answers

Who does science?	f (262)	% (100)
Scientists (Men)	168	64.12
People	32	12.21
Curious Persons	29	11.06
Scientists	15	5.72
Professors	9	3.44
Hardworking Persons	6	2.30
Women Scientists	3	1.15

How Science is done? Primary school students' responses about the third question were analyzed and detected their frequencies and percentages. Many of the students (% 28.27) emphasized science were done through "experiment". The second highest Responses to this question is by "hard-working". Some of the primary school students (% 16.80) expressed "research" while some (% 6.97) expressed "reading books" as an answer for the third question. "Chemistry" was given as an answer by the similar percentage (% 6.56) of the students. Some of the primary students (% 6.15) responded as "discovery & invention" to the question of how the science was done. Three different answers have the same percentage (% 2.87) "thinking, tools, and creativity" for doing science. Some of the students (2.05) pointed "technology" as an answer for doing science. Lastly, four students (% 1.64) responded "intelligence" as an answer for doing science.

Table 6.
Distribution of Third Question's Answers

How science is done?	f (244)	% (100)
By experiment	69	28.27
By hardworking	56	22.94
By research	41	16.80
By reading books	17	6.97
By chemistry	16	6.56
By discovery & invention	15	6.15
By thinking	7	2.87
By tools	7	2.87
By creativity	7	2.87
By technology	5	2.05
By intelligence	4	1.64

Analyses of Drawing Pictures: A total of 135 drawings for three questions were analyzed since some of the primary school students preferred to answer this question written, not drawing. Some of the characteristics about science and scientist were obtained from the 135 drawings in line with the related literature. The table 7 was constructed to show their frequencies and percentages.

Table 7.
3rd Grade Students' Views about Science and Scientists

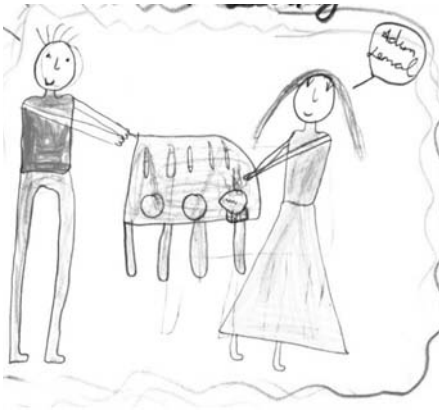
Characteristics of science and scientists	f (135)	% (100)
1. Lab coat (Usually but not necessarily white)	19	14.07
2. Casual clothing	58	42.96
3. Eyewear, (glasses, goggles)	11	8.14
4. Not wearing glasses	92	68.14
5. Facial growth of hair (including beards, mustaches, etc.)	13	9.62
6. Normal cutting hair (shaven beard, smooth -faces)	62	45.92
7. Young people or teenager	90	66.67
8. Middle aged or elderly	11	8.14
9. Personality- positive (nice, normal, caring)	86	63.70
10. Personality- negative (crazy, mad, grump)	6	4.45
11. Professional Collaboration (assistants, colleagues)	47	34.81
12. Professional Isolation (working alone)	59	43.70
13. Female	35	25.92
14. Male	89	65.92
15. Caucasian	103	76.29
16. Symbols of research: instruments and equipment of any kind	71	52.59
17. Symbols of knowledge: e.g. books and file cabinets	16	11.85
18. Technology: the "products" of science'	30	22.22
19. Space-related: Astronaut, space, planets etc.	18	13.34
20. Relevant captions: formulae, classification, the "eureka! etc.	7	5.18
21. Working indoor: laboratory, class etc.	74	54.81
22. Working outdoor: garden etc.	42	31.12
23. Indication of danger	4	2.96
24. Scientist has mythic stereotypes (e.g., Frankenstein creatures, etc.)	1	0.75

During the data analyzes process, some characteristics were defined and analyzed together, for instance; scientists as wearing a lab coat or not, male or female, and young or elderly. First two characteristics were related to clothing. It is important to note that, during the analysis drawings, it was concerned especially primary students' emphasizes in their drawings. For instance wearing a lab coat

or wearing casual clothing. Some of the drawings it is clearly separated these characteristics. However, some of in the drawings it was not possible, because primary students' drawings were primitive and basic, they do not show any clothing.

Some of the primary students (% 14.07) depicted scientists with wearing a lab coat in their drawings (e.g. Drawing 1). However, many of the students (% 42.96) drew scientists as wearing casual clothing (e.g. Drawing 2).

Drawing 1.



Drawing 2.

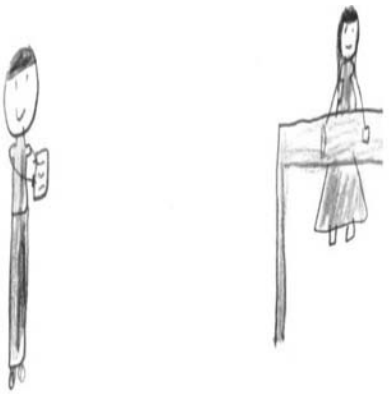
Similar result was found about wearing glasses. Only, 11 (%8.14) students drew scientist wearing glasses (e.g. Drawing 3). On the other hand, many students (% 68.14) pictured scientist as not wearing glasses (e.g. Drawing 4).

Drawing 3.

Drawing 4.

Another characteristic of scientists was related to personal care. Some of the primary students (% 9.62) indicated facial growth of hair or beards etc (e.g. Drawing 5). However, many of the students (% 45.92) specified scientists as normal cutting hair, shaven beard, and smooth-faces in their drawings (e.g. Drawing 6).

Drawing 5.



Drawing 6.

According to the Table 7, some of the students (% 8.14) defined scientists as middle age or elderly (Appendix 1. Drawing 1). Other hand, many of them (% 66.67) drew scientist as young people or teenager (Appendix 1. Drawing 2).

Another characteristic of scientists related to personality. Some of the students (% 4.45) expressed scientists as negative crazy or mad person (Appendix 1. Drawing 3). However, many of the primary students (% 63.70) drew scientists as positive nice or caring person (Appendix 1. Drawing 4).

The data analyzes showed that, in approximately half of the pictures the primary students (% 43.70) depicted scientists as "working alone" (Appendix 1. Drawing 5). On the contrary, some of the students (% 34.81) figured scientist as "working together with their colleagues" in their drawings (Appendix 1. Drawing 6).

Another important data got from students' drawings was about scientists' gender. Some of the students (% 25.92) depicted scientists as female (Appendix 1. Drawing 7), while, many primary students (% 65.92) drew scientists as male (Appendix 1. Drawing 8).

Many of the drawings (% 52.59) included symbols of research; instruments and equipment of any kind (Appendix 1. Drawing 9). Some of the primary students (% 11.85) stated symbols of knowledge, books and file cabinets in their drawings (Appendix 1. Drawing 10).

Some of the primary students (% 22.23) expressed related to technology; the products of science (Appendix 1. Drawing 11). Some other students (% 13.34) stated different indicator related to space, astronaut, planets etc. (Appendix 1. Drawing 12).

Another important indicator related to working area, some of the students (% 31.12) depicted scientists working on outdoor (Appendix 1. Drawing 13). On the other hand, many primary students (% 54.81) figured scientists working indoor, laboratory or class etc. (Appendix 1. Drawing 14).

Only 7 primary students (% 5.18) used relevant captions, formulae, or classification, the "eureka" in their drawings (Appendix 1. Drawing 15). Lastly all of the drawings, in which included scientists (% 76.29) showed scientists as Caucasian (Appendix 1. Drawing 16).

According to the Table 7, four primary students (% 2.96) used indicators of danger in their drawings (Appendix 1. Drawing 17). At the end one student drew Einstein's very famous picture (Appendix 1. Drawing 18), it can be related to mythic stereotypes of scientists.

Discussion

Primary students' written and drawings answers were discussed in two separate parts. First part focused on students' written responses for the three questions. According to results, more than half of the students (% 58.66) answered this question. While defining science, primary students (% 80.67) generally related to knowledge, invention, discovery, and search (experiment). Science is a kind of knowledge. However, science is not equal to knowledge. According to dictionaries science is "a branch of knowledge or study dealing with a body of facts or truths systematically arranged and showing the operation of general laws" (dictionary.reference.com). This definition can be acceptable

Table 8.
Comparison of the Results with National and International Research

Studies about primary students' views on science and scientists	Present study (2012)	Turkmen's study (2008)	Song et al.'s study (2010)	Barman's study (1997)
Primary students' perceptions of science and scientists	Level 3rd % (N=135)	Level 5th % (N=287)	Level 3rd % (N=52)	Level 3rd-5th % (N=649)
1. Scientists wearing a lab coat	14.07	46.70	46.00	41.00
2. Casual clothing	42.96	53.30	---	---
3. Eyewear, (glasses, goggles)	8.14	30.70	23.00	28.00
4. Not wearing glasses	68.14	---	---	---
5. Facial growth of hair	9.62	17.40	7.00	9.00
6. Normal cutting hair	45.92	---	---	---
7. Young person or teenager	66.67	---	---	---
8. Middle aged or elderly	8.14	69.70	32.00	32.00
9. Personality- positive	63.70	61.00	---	---
10. Personality- negative	4.45	---	---	---
11. Professional Collaboration	34.81	---	---	---
12. Professional Isolation	43.70	---	---	---
13. Female	25.92	---	---	---
14. Male	65.92	94.10	55.00	73.00
15. Caucasian	76.29	100.00	71.00	80.00
16. Symbols of research	52.59	86.10	85.00	94.00
17. Symbols of knowledge	11.85	51.20	21.00	35.00
18. Technology; "products" of science	22.22	40.00	15.00	15.00
19. Space-related ; astronaut, or planets	13.34	---	---	---
20. Relevant captions ; « eureka »	5.18	33.50	27.00	13.00
21. Working indoor: laboratory etc.	54.81	79.80	83.00	88.00
22. Working outdoor: garden etc.	31.12	---	---	---
23. Indication of danger	2.96	1.70	21.00	18.00
24. Mythic stereotypes	0.75	2.50	25.00	11.00

for the natural, mathematical sciences. However, this is not suitable for social, philosophical sciences. Another definition of science is "systematic knowledge of the physical or material world gained through observation and experimentation" (dictionary.reference.com). Moreover, primary students defined science as discovery and/or invention results of search/experiments.

According to findings, primary students used "science" terms only for the natural sciences. The second highest answer was "technology" as an answer of the question. There is no one definition everyone agreed on, but one of the favors is a body of knowledge used to make tools, extend skills, and extract or gather materials. Another definition for technology is "applied science". Their meanings passed each other. While, the aim of the technology is the creation of artifacts and systems to meet people's needs, the goal of science the pursuit of knowledge and understanding for its own sake (Sparkes, 1992). Out of the routine, two primary students answered as "curiosity" for the question. Like that one student responded as "creativity" and one student mentioned "entertainment" as a defining of science.

Results showed that more than half of the primary students stated "scientists" as an answers the question. However, this word was used "meaning of men" in Turkish language. This misused not only for this study, but also general misused for Turkish students. It can be concluded that primary students perceived science as "a special work" only done by professional person. Some of the primary students expressed "people", this answer can not be accepted as significant. Some of them stressed "curious persons" as an interesting answer, because students think "curiosity" for science. Just three students put forwarded "women" while answering the question.

More than half of the students related this question to "experiment", "research", "chemistry", and "disco-

very & invention". These answers show the primary students received science as only "experimental science". One of the interest answer was "creativity" for doing science, but its percentage was very low (% 2.87).

Discussion about Students' Drawings: In this part, the present study and other three studies (Barman, 1997; Song et al., 2011; Turkmen, 2008) were compared according to their results. The Table 8 was constructed, since grade of primary students were similar for the three studies. Barman (1997) and Song et al. studies from USA, and the second study showed the development/differences after a decade for USA primary students' views. Turkmen conducted his study in Turkey after the new science and technology curriculum. Therefore, the present study's results are very important for national and international similarities and differences among students' views about science and scientists. In this study, twenty-four characteristics and/or stereotypes were detected, many of them from the literature. However, some of them were new, and they were added below table according to students' drawings. Before the discussion and comparison, one subject should be clarified related to analyzing drawings. In the three studies (Barman, 1997; Song et al.; Turkmen), researchers asked students to draw a scientist. However, in the present study differently asked primary students to draw about science, scientists, and doing science. For that reason, some of the percentages were different. For example, drawing scientists as Caucasian, all of the students drew scientists as Caucasian, but some of the drawings did not include any person (only laboratory equipment or etc.). Therefore, the percentage of Caucasian scientists was reported only % 76.29, not % 100.

During the discussion, the results are interpreted according to 3rd grade primary students' text book, in which related subjects about science and scientists. First characteristics related to scientist's clothing, three studies (Barman, 1997; Song et al., 2011; Turkmen, 2008) have approximately same percentages about wearing a lab coat. Last decade there is no change USA primary students' views. Interestingly, the similar percentage was found by Turkmen. This result parallel other studies in the literature (Bodzin & Gehringer, 2001; Finson, Pedersen, & Thomas, 2006; Fung, 2002; Thomas, Pedersen, & Finson, 2001). Nevertheless, in the present study, the percentage of wearing a lab coat was reduced. It can be concluded that only some of the Turkish 3rd grade students thought scientists wear a lab coat. However, a large percentage of students indicated scientists as wearing casual clothing. One of the possible reasons of this result can be related to students' text books. When examined their life sciences book (MoNE, 2011), there are two pages, in which famous scientists are introduced and included their pictures. In these pictures, scientists do not wear lab coats, they have casual clothing. The result showed a shift in primary students' views of scientists from earlier research (Barman, 1997; Song et al.; Turkmen).

As shown in Table 8, second stereotype of scientists wearing glasses or not. In the present study 3rd grade students' drawings with eyewear rate was decreased according to previous studies (Barman, 1997; Song et al., 2011; Turkmen, 2008). When examined students' text book, there are four famous scientists' pictures, only one of them has eyewear. It can be accepted one of the possible explanation this result.

Another stereotype of scientists is facial growth of hair. While the result of the present study is similar to USA primary students (Barman, 1997; Song et al., 2011), is different from Turkish 5th grade students (Turkmen, 2008). The other specific scientists' characteristic in drawings is related to ages of scientists. Interestingly, the rate of middle or elderly scientists' drawings is very low according to previous studies (Barman, 1997; Song et al., 2011). Especially, difference from Turkmen's results is very important, since at national schools Turkish primary students get the same curricula. This difference can be explained by teacher or parental factors. According to Turkmen primary students obtained their information about scientists from their teachers and parents. Another important indicator is personality of scientists in the drawings. Barman (1997) and Song et al. did not investigate this feature, Turkmen's result slightly low from the present study. This is very important; science educators asserted that students' perceptions affect their attitudes toward science (Bodzin & Gehringer, 2001; Flick, 1990; MacCorquodale, 1984; Rosenthal, 1993; Turkmen).

Another important character about scientists is professional collaboration/isolation. Other three studies (Barman, 1997; Song et al., 2011; Turkmen, 2008) did not mention this subject. The present study showed that many of students drew scientists work with other colleagues. However, more than that drew scientists work alone. According to students' textbook (MoNE, 2011) scientists were pictured alone, therefore it can be concluded books effects on students views on scientist. Scientists gender another issue for students' drawings, male dominant character the Turkish and USA culture. However, the present study showed that, there is

decline for the Turkish students. This can be explained by given examples in school. According to 3rd grade students' textbook three of four scientists are female. This result is very important especially female students' attitudes toward science and scientists. This study gave the rate of female drawings unlike the other three studies (Barman, 1997; Song et al.; Turkmen).

One another stereotype of science is symbol of research, result of this study indicated this trend has changed. This symbol related to instruments and lab equipments. At the same time this is linked to working indoor (laboratory, or closed area). According to previous studies (Barman, 1997; Song et al., 2011; Turkmen, 2008) the present study showed that Turkish primary students have a tendency to exclude indications of working indoor and research equipments. Similar result was found by Narayan, Park, and Peker (2007), the researchers showed that the mean of Turkish students on "symbols of research" was significantly lower than other countries (India, Korea, and USA). The researchers expressed this result, science is not taught at the third grade level as a separate course in Turkey.

Moreover, the present study analyzed students' pictures according to working outdoor, past studies did not concern this characteristic (Barman, 1997; Song et al., 2011; Turkmen, 2008). Technology as a product of science is one of the indicators of science. Turkish primary students have higher rates from USA students (Barman, 1997; Song et al.). This can be explained by recent reforms in Turkish elementary education program. This reform affected the all courses in elementary school, that relate to science by changing "science" course's name as "science and technology" and its contents. One of the new features of science from the earlier research is space-related drawings. In the current study, this issue came forward, but others did not concerned (Barman, 1997; Song et al.; Turkmen). Indication of danger stereotype was very low according to USA students. Lastly, mythic stereotypes, a drawing, which represent Einstein' famous picture (Einstein stuck out his tongue), this is not a stereotype, but it is very interesting for 3rd grade primary student's image.

Conclusion and Implication

According to recent reform movements developing students' views about science accepted an important role in order to grow scientific literate person. Certainly, students' images of scientists are parts of science. Therefore, improving students' perceptions and their drawings are crucial responsibility for curriculum developers, science educators, and classroom teachers.

In recent studies, researchers tried to find which factors affect students' perceptions about science and scientists (She, 1995; Turkmen, 2008). One of the influenced factors was determined as the content of science textbooks and classroom activities (Talsma, 1997). Moreover, McDuffie (2001) investigated teachers' stereotypes images of scientists, his research revealed that teachers' images of scientists are similar to their students on most significant characteristics. In addition, TV programs shape children's views toward science and scientists during primary schools years (cited in Britner & Pajares, 2001; Jones & Bargert, 2006).

In science literature, researchers believed that students build images of scientists and science using their feelings and cognitive domains. Cultural environment, school culture, and classroom experiences affect students' images (Talsma, 2007). Specifically, for Turkish primary students, the current study has some different results from the past studies about primary students in Turkey (Korkmaz & Kavak, 2010; Narayan et al., 2007; Turkmen, 2008). The present results showed that primary students had less stereotypes images for scientists and science according to others. This difference can be explained primary students' grade levels. In this study, students were 3rd grade, while others at least 4th grade and upper. In Turkish primary educational system, "science" course is started as a separate course from 4th grade level. As science educators, curriculum developers, and teachers we should think about this subject and do self-criticism. Why our primary students draw more stereotype images of scientists after the third grade? Future studies can focus on this question, their answers may help us to develop science curricula for primary students and program for pre-service teacher training.

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Appendix 1.

Students' drawings about the stereotypes of scientists.

Drawing 1.

Drawing 2.

Drawing 3.

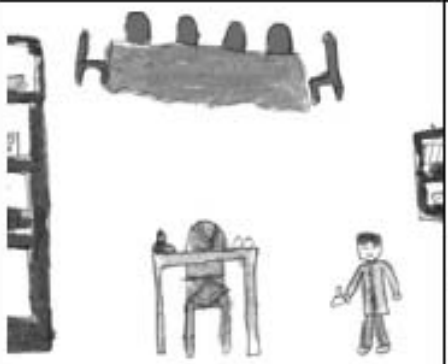
Drawing 4.

Drawing 5.

Drawing 6.

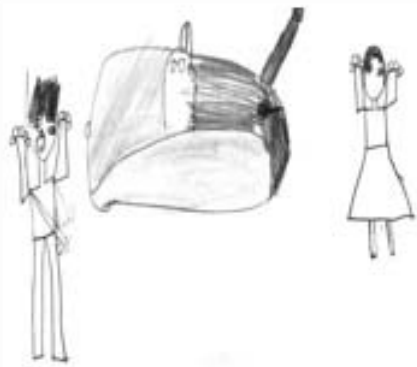
Drawing 7.

Drawing 8.

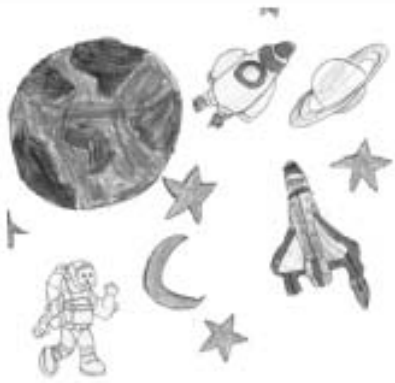


Drawing 9.

Drawing 10.

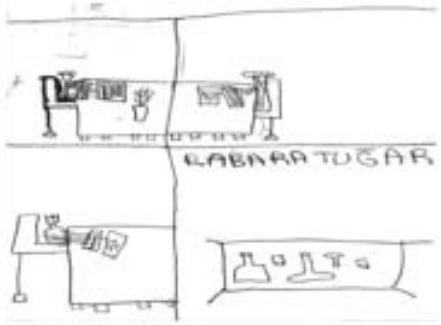


Drawing 11.



Drawing 12.

Drawing 13.



Drawing 14.

Drawing 15.

Drawing 16.

Drawing 17.

Drawing 18.